

RECORDING MEDIUM RESIDUAL AMOUNT DETECTING DEVICE,  
IMAGE FORMING APPARATUS PROVIDED WITH DEVICE, AND  
PROGRAM FOR OPERATING COMPUTER

5           This application is a continuation of  
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10

BACKGROUND OF THE INVENTION

Field of the Invention

          The present invention relates to a residual  
amount detecting device for detecting information  
15   concerning a residual amount of recording media, an  
image forming apparatus provided with a residual  
amount detecting device, and a program for operating  
a computer connected directly or indirectly with the  
image forming apparatus.

20   Reated Background Art

          Up to now, as image forming apparatuses used  
for a printer, a copying machine, a facsimile, and a  
multifunctional machine having those functions, and  
an output apparatus of a work station and electronic  
25   equipment including a computer etc, there are  
enumerated a laser beam printer (LBP), an inkjet  
printer (IJP), a thermal printer, and the like. Such

image forming apparatuses can form an image on a recording medium inclusive of paper and an OHP film based on image information.

The image forming apparatuses are generally provided with a recording medium feeder (SF: sheet feeding apparatus) or a recording medium cassette so that the apparatus can have plural sheets of the recording medium stacked therein. However, when images are to be outputted on plural sheets, all recording media in the SF may be consumed before a user completes image formation for a desired number of sheets.

For example, a case is considered where 10 printing sheets are stacked in the SF. In this case, even when the user issues a command for outputting images on 100 sheets through a computer, after finishing the 10th printing, the image forming apparatus notifies the user that there is no sheet left for the 11th printing. Then, the user receiving the notification needs to actually go to the apparatus to replenish the recording media.

However, such a system is inconvenient, in which notification is performed after consuming all the printing sheets, because the user has to always pay his/her attention whether or not the printing sheets are sufficiently provided to the image forming apparatus during the printing operation.

In the days to come, in particular, it is expected that a single image forming apparatus is shared among a number of users and host devices through a network more often. Therefore, it is  
5 difficult for each user himself to figure out the exact remaining number of sheets being stacked.

#### SUMMARY OF THE INVENTION

In view of the above, the present invention has  
10 been made, and an object thereof is to provide a residual amount detecting device capable of detecting information concerning a residual amount of recording media even before consuming the recording media stacked in an SF or a recording medium cassette. In  
15 addition, another object of the present invention is to provide an image forming apparatus capable of outputting information concerning the residual amount of recording media irrespective of the presence or absence of the recording media stacked in the image  
20 forming apparatus. Also, another object of the present invention is to detect presence or absence of the recording media.

A residual amount detecting device for detecting information concerning a residual amount of  
25 a recording medium according to the present invention, includes: external force applying means that applies an external force to a recording medium group in a

thickness direction thereof; and external force detecting means that detects the external force applied to the recording medium group, in which the external force detecting means is disposed such that  
5 the recording medium group is set in a position between the external force applying means and the external force detecting means.

The external force applying means and the external force detecting means can be composed of,  
10 for example, a first electrode capable of being in contact with a front surface of the recording medium group and a second electrode capable of being in contact with a rear surface of the recording medium group, as well as voltage applying means for applying  
15 a voltage between the first electrode and the second electrode.

In the recording medium residual amount detecting device, the information concerning the residual amount of the recording medium may be  
20 detected by comparing a signal stored in advance in a storage circuit corresponding to the residual amount, with a signal detected by the external force detecting means.

The residual amount detecting device may  
25 further include warning means that issues, when a remaining number of the recording medium is equal to or less than a predetermined value, a warning that

the remaining number is equal to or less than the predetermined value.

It should be noted here that the image forming apparatus specified in the present invention is  
5 adapted to perform printing (or thermal transfer) of characters, graphics, and the like on paper (plain paper, glossy paper, and high quality dedicated paper, for instance) or OHP films serving as the recording medium.

10 An image forming apparatus according to the present invention includes detecting means that detects information concerning a residual amount of a recording medium stacked in the image forming apparatus, in which the information is outputted as  
15 electronic information irrespective of the presence or absence of the recording medium.

Note that the information concerning the residual amount of the recording medium is information of a remaining number of the recording  
20 medium stacked or information indicating that at least a predetermined number of sheets are remained. Further, the phrase "irrespective of the presence or absence" implies that the information is outputted when the recording medium is absent or even before  
25 using up the recording medium.

The electronic information includes information to be displayed on a display part provided in the

image forming apparatus or on a display of a computer connected with the image forming apparatus.

A method of operating an image forming apparatus according to the present invention,  
5 includes: receiving an image forming command;  
determining whether or not a residual amount of a recording medium is sufficient enough to complete image formation in response to the image forming command; and outputting when applicable, information  
10 indicating that the residual amount of the recording medium is not sufficient enough to complete the image formation. It is particularly preferable that the information is outputted on a screen of a computer connected to the image forming apparatus.

15 A program which is executed by a computer connected directly or via a network with an image forming apparatus according to the present invention, includes: obtaining information concerning a residual amount of a recording medium stacked in the image  
20 forming apparatus; and displaying the information on a screen of the computer. The information described here refers to, for example, information of a remaining number of the recording medium or information indicating that at least a predetermined  
25 number of sheets are remained. The information may of course be provided in a form of graphic or character expressed visually to a user. Note that

the program may further include displaying the information for every image forming apparatus with respect to plural image forming apparatuses connected directly or indirectly with the computer.

5           A program according to another aspect of the present invention program includes: obtaining information concerning plural image forming apparatuses connected directly or indirectly with a computer; allocating tasks of image formation process  
10 to be executed by the plural image forming apparatuses in response to an image forming command from a user; and issuing an image formation starting command to each of the plural image forming apparatuses having an allocated task of the image  
15 formation process.

          A residual amount detecting device for detecting the sheet number of the recording medium stacked in the recording medium stacking means according to the present invention, includes: two electrodes  
20 interposing the recording medium therebetween; high frequency voltage detecting means that detects the high frequency voltage flowing between the two electrodes; and sheet number detecting means that detects the sheet number of the recording medium  
25 stacked in the recording medium stacking means based on the high frequency voltage detected by the high frequency voltage detecting means.

One of the electrodes of the residual amount detecting device of the present invention is preferably provided on a claw for tightening up the recording medium at a constant pressure in the recording medium stacking means, whereas the other electrode is provided opposite thereto in the recording medium stacking means. The electrode having the claw in the residual amount detecting device of the present invention may be structured to linearly move close to or apart from the recording medium.

The sheet number detecting means of the residual amount detecting device of the present invention preferably includes: a high frequency voltage versus recording medium sheet number storage circuit capable of storing the sheet number of the recording medium with respect to the high frequency voltage; and a sheet number computing circuit that computes the sheet number of the recording medium from the high frequency voltage versus recording medium sheet number storage circuit based on the high frequency voltage detected by the high frequency voltage detecting circuit. In the high frequency voltage versus recording medium sheet number storage circuit of the sheet number detecting means, there is stored in advance sheet numbers of the recording medium with respect to high frequency voltages. In other words,



when the high frequency voltage is small, the sheet number of the recording medium is stored as large, and when the high frequency voltage is large, the sheet number of the recording medium is stored as

5 small. When the high frequency voltage is detected by the high frequency voltage detecting means, the sheet number computing circuit of the sheet number detecting means reads out the sheet number of the recording medium corresponding to the detected high

10 frequency voltage, from the high frequency voltage versus recording medium sheet number storage circuit. As a result, the sheet number of the recording medium stacked in the recording medium stacking means is detected. The high frequency voltage versus

15 recording medium sheet number storage circuit of the residual amount detecting device of the present invention stores the recording medium sheet numbers with respect to the high frequency voltage for every thickness of the recording medium. In the residual

20 amount detecting device, the thickness of one sheet of the recording medium varies due to a material constituting the recording medium. In a case where the recording medium has a large thickness, the thickness of the recording medium as a whole becomes

25 large for the same sheet number of the recording medium, and the interelectrode distance accordingly becomes large. Thus, the high frequency voltage

detected by the high frequency voltage detecting means becomes small. On the other hand, In a case where the recording medium has a small thickness, the thickness of the recording medium as a whole becomes

5 small for the same sheet number of the recording medium, and the interelectrode distance accordingly becomes small. Thus, the high frequency voltage detected by the high frequency voltage detecting means becomes large. In this way, even when the same

10 high frequency voltage is detected by the high frequency voltage detecting means, the remaining number of the recording medium varies if the thickness of one sheet of the recording medium is different. To cope with that, the high frequency

15 voltage versus recording medium sheet number storage circuit is adapted to store the recording medium sheet numbers with respect to the high frequency voltage for every thickness of the recording medium. Accordingly, it is possible to detect the exact

20 remaining number of the recording medium in accordance with the thickness of the recording medium.

In a preferred mode, the residual amount detecting device of the present invention may be provided with recording medium sheet number display

25 means that displays the sheet number of the recording medium stacked in the recording medium stacking means. The residual amount detecting device of the present

invention includes warning means that issues as  
needed a warning that the sheet number of the  
recording medium stacked in the recording medium  
stacking means is equal to or less than a  
5 predetermined sheet number.

An image forming apparatus according to the  
present invention includes: recording medium stacking  
means that stacks a recording medium therein;  
residual amount detecting device that detects the  
10 sheet number of the recording medium stacked in the  
recording medium stacking means; convey means that  
conveys the recording medium from the recording  
medium stacking means; and image formation means that  
forms an image on the recording medium conveyed by  
15 the convey means.

The image forming apparatus of the present  
invention further includes means that issues as  
appropriate a warning that the sheet number of the  
recording medium stacked in the recording medium  
20 stacking means is equal to or less than a  
predetermined sheet number, and stops the conveyance  
of the recording medium.

According to another aspect of the present  
invention, there is provided an information detecting  
25 apparatus for detecting information of presence or  
absence of a recording medium, including; external  
force applying means that applies an external force

to a recording medium group in a thickness direction thereof; and external force detecting means that detects the external force applied to the recording medium group, in which the external force detecting means is disposed such that the recording medium group is set in a position between the external force applying means and the external force detecting means. As described above, before the recording medium stacked in the recording medium is used in its entirety, it is exceedingly preferable to detect information concerning the residual amount thereof. The presence or absence of the recording medium may of course be detected by using the above-mentioned external force applying means and external force detecting means. For example, if a signal in a case of the absence of the recording medium is stored in advance, and a signal from the detecting device becomes the same as that stored in advance, then information can be obtained indicating that the recording medium is used up.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a diagram illustrative of the present invention;

Fig. 2 is a diagram illustrative of the present invention;

Fig. 3 shows a sequence illustrative of the

present invention;

Fig. 4 is a diagram illustrative of an embodiment of the present invention;

Fig. 5 is a graph schematically showing the  
5 relation between the residual amount of a recording medium and a high frequency voltage;

Fig. 6 is a schematic diagram showing the relation between a residual amount detecting device and a peripheral circuit diagram; and

10 Fig. 7 is a schematic diagram of an inkjet printer provided with a recording medium residual amount detecting device.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

15 (First Embodiment Mode: Recording Medium Residual Amount Detecting Device)

Referring to Fig. 1, a recording medium residual amount detecting device according to a first embodiment mode of the present invention will be  
20 described. In the drawing, a recording medium group 11 is located between external force applying means 1012 and external force detecting means 1010.

With this structure, the external force detecting means 1010 can detect signals in accordance  
25 with the residual amount of a recording medium. The recording medium group used in this specification is a concept including a case of a single sheet in

addition to a case of plural sheets of course.

The external force includes a voltage, a vibration, and an impact, applied from the outside to the recording medium group. It is needless to  
5 mention that they may be used in combination to produce the external force. In Fig. 1, the external force applying means 1012 is provided only in an end region of the recording medium group 11. However, the external force applying means 1012 may of course  
10 be provided so as to cover the entire surface or provided across the entire width thereof. This point is also applicable to the external force detecting means 1010. Further, it is allowable to provide plural external force applying means and plural  
15 external force detecting means. As far as the external force can be applied or the external force can be detected, another member may be interposed between the external force applying means (or detecting means) and recording medium group.  
20 Hereinafter, a description will be given concerning the external force used in this embodiment mode.

In a case where a voltage is applied as the external force, the external force applying means 1012 and the external force detecting means 1010 are  
25 each composed of an electrode in contact with the recording medium group 11. Then, a voltage having a predetermined frequency is applied between the

electrodes. The predetermined frequency is a frequency having on the order of several kHz to 500 kHz for instance. The interelectrode distance varies depending on the amount of the recording medium group.

- 5 To be specific, as the amount (the remaining number) of the recording medium decreases, the interelectrode distance becomes smaller. Thus, a voltage to be detected by the detecting means becomes larger.

- The structure may be preferable such that one  
10 of the external force applying means and the external force detecting means functioning as electrodes is fixed and the other is pressed against the recording medium group by a spring or the like, or such that the external force applying means and the external  
15 force detecting means are both pressed against the recording medium group. It should be noted here that if employing the structure of causing at least one of the means to be pressed against the recording medium group, it is preferable that the external force  
20 applying means and the external force detecting means are physically separated from each other.

- As the external force, a voltage having a constant value (fixed voltage) may be used instead of the voltage having the predetermined frequency. The  
25 remaining number of the recording medium may be detected by using the two electrodes described above based on the change in capacitance caused by the

change in remaining number thereof. In other words, any phenomenon can be utilized in which the interelectrode distance is changed according to the remaining number of the recording medium.

5           In a case where a vibration is applied as the external force, the external force applying means 1012 and the external force detecting means 1010 are each composed of a piezoelectric element such as a PZT. When a voltage having a predetermined frequency  
10 is applied to the external force applying means, the vibration is propagated from the surface of the recording medium group 11. Then, the vibration propagated in the thickness direction of the recording medium group is detected by the  
15 piezoelectric element functioning as a detecting part. In this case also, any phenomenon can be utilized in which the intensity of vibration to be detected by the detecting part is changed according to the amount of the recording medium group. Instead of applying  
20 the vibration as the external force, an impact may be applied. Specifically, the surface of the recording medium group is tapped by the external force applying means 1012, or the surface of the recording medium group is pressed against the external force applying  
25 means 1012. For a more convenient method, an impact member is dropped from a location at a constant height with respect to the bottom surface of the



recording medium group.

The external force is described so far in detail.  
When the external force is applied and then detected,  
it is preferable that the recording medium group is  
5 at rest in view of reducing the unnecessary noise.

If the recording medium group is continuously or  
continually applied with the external force, which is  
then detected, it is possible to find a time when one  
sheet of the recording medium begins to be conveyed  
10 from a stack part of the recording medium group for  
instance.

In the recording medium residual amount  
detecting device described above, information  
concerning the residual amount of the recording  
15 medium group can be detected by comparing a signal  
which is stored in advance in a storage circuit  
corresponding to the residual amount, with a signal  
detected by the external force detecting means.

The information concerning the residual amount  
20 may be information of the actual remaining number of  
the recording medium or information indicating that  
the remaining number is equal to or more than a  
predetermined number.

In the early stage of the recording medium  
25 residual amount detecting device brought into service,  
first, it is preferable to find which kind of signals  
to be detected when a predetermined sheets of the

recording medium are stacked.

The recording medium residual amount detecting device may further be provided with warning means that issues as occasion arises a warning that the  
5 remaining number of the recording medium group is equal to or less than a predetermined number.

According to this embodiment mode, it is possible to detect the residual amount of the recording medium group in a state of being stacked.  
10 In a container in which the recording medium group is stacked, the residual amount of the recording medium group can be detected while the recording medium group is at rest. To be more specific, the entire recording medium group may completely be at rest (in  
15 a state where the group is not conveyed at all), or a recording medium on the surface side among the recording medium group may be in the course of being conveyed. In a case where the detection is performed during a recording medium on the surface side among  
20 the recording medium group is being conveyed, the one recording medium being conveyed may be included or excluded when the residual amount is detected.  
(Second Embodiment Mode: Image Forming Apparatus Having Residual Amount Detecting Device Mounted  
25 Thereon)

A second embodiment mode of the present invention will be described with reference to Fig. 2.

Reference numeral 220 denotes an image forming apparatus schematically shown in a perspective view. Reference numeral 200 denotes stacking means of a recording medium group. The stacking means 200 has  
5 mounted thereon a residual amount detecting device capable of detecting information concerning the residual amount of a recording medium group irrespective of the presence or absence of the recording medium group, which is described in the  
10 first embodiment mode, for instance.

The information concerning the residual amount includes information of the actual remaining number of the recording medium, information indicating that the remaining number is equal to or more than a  
15 predetermined number, and information indicating that the recording medium falls short to complete printing instructed by a user. These information can be displayed on an information display part (denoted by reference numeral 230 in Fig. 2) which is actually  
20 provided in the image forming apparatus or be outputted by means of light or warning sound such as buzzer. Such information may of course be displayed on a screen of a computer connected directly or via a network with the image forming apparatus.

25 A specific example of sequences applicable to this embodiment mode is shown here.

As shown in Fig. 2, in this specific example, a

printer serving as the image forming apparatus 220 is in a state of being connected via a network 240 with a computer 210 used by a user. Fig. 3 shows the specific sequence example.

5           First, an image forming command is sent to the image forming apparatus 220 (S1). The user may directly send such a command to the image forming apparatus or indirectly send the command from the screen of the computer 210 connected with the image  
10 forming apparatus via the network.

          Next, it is determined whether or not the residual amount of the recording medium is sufficient to complete instructed image formation by using a detection signal from the recording medium residual  
15 amount detecting device mounted on the image forming apparatus (S2). The determination may be performed in the image forming apparatus or in the computer 210 connected directly or indirectly with the image forming apparatus. During image formation in  
20 response to an image forming command having been sent in first by another user (previous command), if the above-mentioned detecting command is issued (subsequent command); it is also possible that the detection of the residual amount of the recording  
25 medium is not performed, and the residual amount of the recording medium previously detected and the number of the recording medium to be subjected to

image formation in response to the previous command are taken into consideration to perform the determination of S2.

If it is determined that the instructed image formation can completely be performed, printing starts (S3-1). If the amount of the recording medium is not sufficient for the printing, information of insufficient recording medium is outputted (S3-2). Accordingly, the user becomes free from regular control of whether or not the recording medium is running short during the printing.

The user receiving the information of insufficient recording medium may replenish the recording medium and send a command for the start of image formation, or may send the command without replenishing the recording medium

According to another mode, a system is also applicable in which the residual amount of the recording medium is constantly detected to display the image formation allowable sheet number. The term "constantly" implies here that the detection may be performed continuously on a time base or performed intermittently at predetermined time intervals. In a case of displaying the image formation allowable sheet number, it suffices that the residual amount of the recording medium actually stacked in the image forming apparatus is displayed. However, in a case

of having previously received an image forming command from another user, it is more preferable to display the amount of the recording medium found by subtracting by the sheet number thereof to be used in response to the image forming command. However, information may of course be displayed indicating "there are at least a predetermined number of sheets left" etc instead of displaying the exact remaining number.

10        If plural printers are usable through the network, it is preferable to display information of the respective printers concerning the image formation allowable sheet number etc along with icons for the printers on the screen. For example, icons  
15        denoted by reference numeral 250 are shown in Fig. 2. In this case, the user may select a printer as needed.

By use of information for each of plural printers concerning the image formation allowable sheet number etc (assuming that a first image forming  
20        apparatus (printer) has 30 sheets of the recording medium left, and a second image forming apparatus has 90 sheets left), the following system for example is enabled.

That is, when a user A issues a command of image  
25        formation for 100 sheets on a computer, the computer automatically takes into consideration the residual amount of the recording medium of each image forming

apparatus, and sends a command of image formation for only 30 sheets to the first image forming apparatus and a command of image formation for the remaining 70 sheets to the second image forming apparatus. In  
5 such a case, through complementing the shortage of the recording medium among the plural image forming apparatuses, it becomes possible to perform image formation without replenishment of the recording medium. It is of course preferable to display  
10 information on a computer display on the user side, which indicates that 30 sheets are (or to be) printed by the first image forming apparatus and 70 sheets are (or to be) printed by the second image forming apparatus

15 A program executing the various modes (or systems) described above may be stored in the image forming apparatus or in the computer connected therewith via the network etc.  
(Embodiment)

20 Hereinafter, an embodiment of the present invention will be described with reference to Figs. 4 to 7.

Based on Fig. 7, an inkjet printer is described which is an example of an image forming apparatus  
25 provided with a recording medium residual amount detecting device.

The residual amount detecting device of the

present invention can be provided not only to the inkjet printer but also to a copying machine, a facsimile, and a multifunctional machine having those functions.

5           An inkjet printer (IJP) 100 conveys a recording medium stacked in recording medium stacking means 101 by pickup rollers 102 and performs leading edge detection of the recording medium. After the detection, the IJP further conveys the recording  
10 medium to a printing position to form an image thereon, and then delivers it to recording medium delivery means 104.

Next, a residual amount detecting device will be described with reference to Figs. 4 to 7.

15           In Fig. 4, a lower electrode 10 is mounted to the recording medium stacking means 101, and a spring 13 is adapted to tighten up a recording medium group 11 in the stacking means 101 toward an upper electrode 12. The two electrodes function as  
20 external force applying means and external force detecting means described in the present invention.

In this drawing, the lower electrode 10 and the upper electrode 12 are disposed opposing each other while interposing the recording medium 11  
25 therebetween. In a state where a given amount of the recording medium 11 is stacked in the recording medium stacking means 101 as shown in the drawing,



the interelectrode distance is large. In such a state, a small high frequency voltage is detected by high frequency voltage detecting means 15. On the other hand, as the remaining number of the recording medium 11 in the recording medium stacking means 101 decreases, the interelectrode distance becomes smaller effectively. As a result, the high frequency voltage detected by the high frequency voltage detecting means 15 increases. Fig. 5 is a graph showing the relation between the residual amount of the recording medium 11 and the detection voltage when applying a sine wave having a frequency of 137.6 kHz with a voltage value of 5 V between the two electrodes on the recording medium stacking means 101. As the recording medium 11, there is used plain paper such as New Printer Paper (CP-250: manufactured by Canon Inc.)

As shown in Fig. 5, when the recording medium 11 has 5 sheets, the high frequency voltage of about 56 mV is obtained. As the sheet number in the recording medium stacking means 101 decreases, the high frequency voltage increases. When only one sheet is left, the high frequency voltage of 545 mV is obtained. It should be noted here that when the recording medium 11 is used up from the recording medium stacking means 101, the high frequency voltage detecting means detects 5 V being applied between the

electrodes. Thus, a state can be detected in which there is no recording medium 11 remained in the recording medium stacking means 101.

As shown in Fig. 6, the high frequency voltage  
5 detecting means 15 is connected to sheet number  
detecting means 16. The sheet number detecting means  
16 reads out the sheet number of the recording medium  
11 based on recording medium sheet numbers with  
respective to the high frequency voltage, which are  
10 stored in a high frequency voltage versus recording  
medium sheet number storage circuit 19, and then  
computes the current sheet number of the recording  
medium 11 stacked in the recording medium stacking  
means 101.

15 The high frequency voltage versus recording  
medium sheet number storage circuit 19 may be adapted  
to store the recording medium sheet numbers with  
respect to the high frequency voltage for every  
recording medium different in thickness due to the  
20 difference of a material constituting the recording  
medium 11. In this case, when the user specifies a  
kind of the recording medium by setting properties,  
it is possible to automatically compute the sheet  
number based on data of the recording medium sheet  
25 numbers with respect to the high frequency voltage in  
accordance with the kind of the recording medium 11.

With this structure, the residual amount

detecting device estimates the sheet number of the recording medium 11 stacked in the recording medium stacking means 101 from the high frequency voltage. Although not shown in the drawings, a signal from the  
5 sheet number detecting means 16 is transmitted to a host device side via an interface 18 of the image forming apparatus. On the host device side, printing data is generated upon the reception of the signal, and then transferred to the image forming apparatus  
10 side.

The image forming apparatus receiving the printing data operates a printing head with a control circuit of an inkjet head to form an image on the recording medium 11. A display part 17 displays  
15 information when the sheet number of the recording medium 11 remained in the recording medium stacking means 101 is reduced to a predetermined sheet number.

Further, if a comparison operational circuit is provided to compare the processing sheet number  
20 instructed by the user with the remaining number from the sheet number detecting means 16, a warning can also be issued to the user that the processing sheet number is less than the remaining number. Furthermore, it is also possible to detect a  
25 situation where the recording medium 11 is absent in the recording medium stacking means 101. At this time, a warning can be given to the user, or it is

possible to restrain the image forming apparatus from operating.

According to the present invention, it is possible to detect information concerning the residual amount of the recording medium even before using up the recording medium group stacked in the image forming apparatus.

In the image forming apparatus, in general, recording medium supply rollers rotate and if the recording medium is conveyed in accordance with the roller rotation to a sensor position within a given time, the sensor works to determine that the recording medium is "present", thereby entering a image formation mode. In a case where the recording medium is not remained, the recording medium supply rollers idly rotate, no recording medium is conveyed to the sensor position with in the given time, it is determined that the recording medium is "absent", and a warning sound or a warning message "there is no sheets left" or the like is given to the host device or the user. Therefore, the number of the recording medium is unknown to the host device and the user until the recording medium is used up. In a case of a network printer, in particular, the printer is set in a position far from the host device and the user in many cases. Thus, the user needs to go round the network printer to replenish the recording medium

after the recording medium is completely used.  
However, according to this embodiment, it becomes  
possible to detect information concerning the  
residual amount of the recording medium before the  
5 recording medium runs out.

When the information cannot be obtained  
concerning the residual amount of the recording  
medium before it is used up, the recording medium  
supply rollers idly rotate due to no supply of the  
10 recording medium, degradation of the rollers due to  
contact or friction with separation pads is  
accordingly effected, and also shavings are produced.  
Therefore, to avoid the above situation, there is a  
need to use a material superior in durability for the  
15 supply rollers. In contrast, according to this  
embodiment, a degree of freedom increases to choose a  
material for components.